Warm Up 12

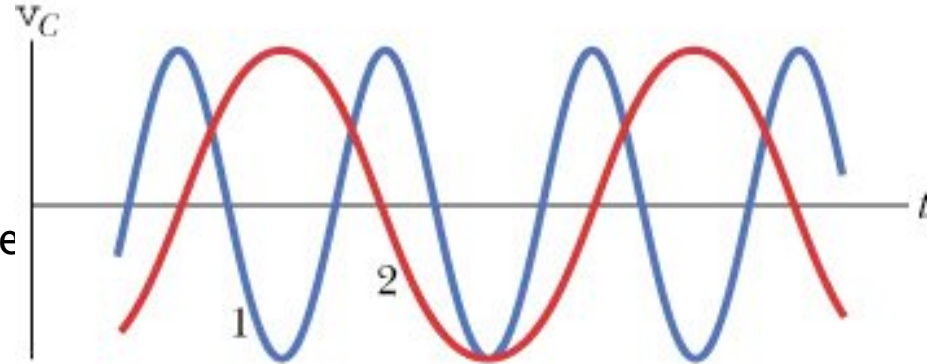## Question

v_C

1. The figure shows graphs of capacitor voltage v_c for LC circuits 1 and 2, which contain identical capacitances and have the same maximum charge Q.

Are (a) the inductance of L and (b) the maximum current I in circuit 1 greater than, less than, or the same as those in circuit 2?

(a) greater than
(b) the same as
(c) less than

Answer:

The inductance in Circuit 1 is less than in Circuit 2
The maximum current in Circuit 1 is greater than in circuit 2

The natural frequency of circuit 1 is greater than that of circuit 2, and because the inductance and the frequency are inversely related, Circuit 2 has the higher inductance.

$$\omega = \frac{1}{\sqrt{LC}}$$

Impedance Z directly proportional to L, and thus Z for Circuit 2 is the greatest. But maximum current I is inversely related to Z, and so I in Circuit 1 is greatest.

$$Z = \sqrt{R^2 + (\omega L - \frac{1}{\omega C})^2}$$

$$I = \frac{\varepsilon_m}{\sqrt{R^2 + (X_L - X_C)^2}} = \frac{\varepsilon_m}{Z}$$